CLAIMS

1. A carbon monoxide oxidizer comprising:

a mixing unit (5) that mixes at least two kinds of gases as a mixed gas, the mixing unit (5) comprising a stacked body (9, 190-192, 200-202) of a plurality of plates (100A-100F, 110A-110G, 120A-120I, 130A-130G, 140A-140J, 150, 160, 170, 221-224, 230-233, 260A-260F), the stacked body comprising a rotating passage (101, 111, 121, 131, 143, 144, 151, 161, 162, 171, 172, 193-195, 203-205) formed by a through hole (101A-101F, 111A-111G, 121A-121I, 131A-131G, 143A-143J, 225-228, 234-237, 261A-261F) formed in each of the plates (100A-100F, 110A-110G, 120A-120I, 130A-130G, 140A-140J, 150, 160, 170, 221-224, 230-233, 260A-260F), to rotate a flow of the mixed gas.

2. The carbon monoxide oxidizer as defined in Claim 1, wherein the through-hole (101A-101F, 111A-111G, 121A-121I, 131A-131G, 143A-143J, 225-228, 234-237, 261A-261F) in each of the plates (100A-100F, 110A-110G, 120A-120I, 130A-130G, 140A-140J, 150, 160, 170, 221-224, 230-233, 260A-260F) is formed so that a size of a through-hole is different from the size of an adjacent through hole.

3. The carbon monoxide oxidizer as defined in Claim 2, wherein the size of a through-hole (101A-101F) increases as the mixed gas flows downstream.

4. The carbon monoxide oxidizer as defined in Claim 1, wherein the plates (100A-100F) increase in thickness as the mixed gas flows downstream.

5. The carbon monoxide oxidizer as defined in Claim 1, wherein the through-hole (101A-101F, 111A-111G, 121A-121I, 131A-131G, 143A-143J, 225-228, 234-237, 261A-261F) in each of the plates (100A-100F, 110A-110G, 120A-120I, 130A-130G, 140A-140J, 150, 160, 170, 221-224, 230-233, 260A-260F) is formed so that a forming position of a through-hole is different from the forming position of an adjacent through-hole.

6. The carbon monoxide oxidizer as defined in Claim 1, wherein the stacked body (9, 190-192, 200-202) have a plurality of rotating passages (121, 122, 143, 144, 151, 161, 162, 171, 172, 193-195, 203-205).

7. The carbon monoxide oxidizer as defined in Claim 6, wherein the plurality of the rotating passages (161, 162) are configured to have different cross-sectional areas.

8. The carbon monoxide oxidizer as defined in Claim 6, wherein the plurality of the rotating passages (171, 172) are configured to rotate the mixed gas in different directions from each other.

9. The carbon monoxide oxidizer as defined in any Claim 1, wherein the mixing unit (5) further comprises a porous body (30) through which the mixed gas flows, which is located downstream of the stacked body (9).

10. The carbon monoxide oxidizer as defined in Claim 1, wherein the mixing unit (5) comprises a plurality of stacked bodies (9, 190-192, 200-202) arranged in series in a flow direction of the mixed gas.

11. The carbon monoxide oxidizer as defined in Claim 10, wherein one of the plurality of the stacked bodies (190-192) comprises a rotating passage (193-195) rotating in a different rotating direction from a rotating direction of a rotating passage in an adjacent stacked body.

12. The carbon monoxide oxidizer as defined in Claim 10, wherein the plurality of the stacked bodies (200-202) respectively comprise a rotating passage (203-205) having a different size.

13. The carbon monoxide oxidizer as defined in Claim 1, wherein the carbon monoxide oxidizer further comprises a porous body (43) carrying a carbon monoxide preferential oxidation catalyst, which is located downstream of the mixing unit (5).

14. The carbon monoxide oxidizer as defined in any one of Claim 1 through Claim 13, wherein the two kinds of gases are a reformate gas that contains hydrogen produced by reforming a hydrocarbon fuel, and an oxidant gas.

15. The carbon monoxide oxidizer as defined in Claim 14, wherein the mixing unit (5) further comprises an oxidant gas introducing passage (133, 141, 142)

formed inside the stacked body (9), which supplies the oxidant gas to the rotating passage (131, 143, 144).

16. The carbon monoxide oxidizer as defined in Claim 15, wherein the oxidant gas introducing passage (133, 141, 142) is formed in one of the plates (130B, 140B) forming the stacked body (9).

17. The carbon monoxide oxidizer as defined in Claim 14, wherein the carbon monoxide oxidizer further comprises an oxidant gas supply unit (4) comprising an orifice (220A) that reduces a cross-sectional area of a flow of the reformate gas and a blowout hole (218) spurting out the oxidant gas toward the reformate gas passing through the orifice (220A), and the mixing unit (5) further comprises a chamber (210) between the oxidant supply unit (4) and the stacked body (9), the chamber (210) having a larger cross-sectional area than the cross-sectional area of the orifice (220A).

18. The carbon monoxide oxidizer as defined in Claim 17, wherein the blowout hole (218) is formed at a position offset from a center line of the orifice (220A) so as to cause the oxidant gas to form a rotating flow in the orifice (220A).

19. The carbon monoxide oxidizer as defined in Claim 18, wherein a rotating direction of the oxidant gas produced by the blowout holes (218) is set to be inverse to the rotating direction of the mixed gas in the stacked body (9).

20. The carbon monoxide oxidizer as defined in Claim 17, wherein the mixing unit (5) further comprises a guide (314) arranged inside the chamber (210) that refracts a flow of the mixed gas flowing from the orifice (220A) toward the stacked body (9).

21. The carbon monoxide oxidizer as defined in Claim 17, wherein each of the through-holes (225-228, 234-237) is formed so that a width of the through-hole expands in a radial direction from a center of each of the plates (221-224, 230-233).

22. The carbon monoxide oxidizer as defined in Claim 17, wherein the oxidant gas supply unit (4) comprises a plurality of blowout holes (218) selectively used based on a flow amount of the reformate gas.

23. The carbon monoxide oxidizer as defined in Claim 17, wherein each of the plates (260A-260F) comprises a passage (262) that circulates a cooling medium.

24. The carbon monoxide oxidizer as defined in Claim 17, wherein the mixing unit (5) further comprises a porous body (27) arranged in the rotating passage (101) carrying a carbon monoxide preferential oxidation catalyst.